

REMARKS

Applicant respectfully requests reconsideration. Claims 1-7 were previously pending for examination in this application. By this amendment, Applicant is canceling claims 8-9 without prejudice or disclaimer as being drawn to a non-elected invention. No claims have been amended. As a result, claims 1-7 remain pending for examination with claim 1 being an independent claim. No new matter has been added.

Rejections Under 35 U.S.C. §102

Claims 1-6 stand rejected under 35 U.S.C. §102(b) as being anticipated by Tuppen (U.S. Patent No. 5,279,687). Applicant respectfully traverses this rejection.

Independent claim 1 is directed to a method for forming, by epitaxy, a heteroatomic single-crystal semiconductor layer on a single-crystal semiconductor wafer, the crystal lattices of the layer and of the wafer being different. The method comprises forming, before the epitaxy, in the wafer surface, at least one ring of discontinuities around a useful region, the discontinuities being at least one rough area.

Tuppen is directed to preparing semiconductor substrates by annealing epitaxial layers in the form of mesas. As explained by Tuppen, annealing a secondary substrate formed by a primary wafer, such as a silicon wafer, and a mismatched epilayer, such as a Si/Ge alloy layer, relieves the strain created by the mismatch of cell sizes between the wafer and the epilayer.

Tuppen discloses two methods of forming the secondary substrate which is subsequently annealed to relieve strain.

In a first method, an unmasked substrate, e.g., a Czochralski wafer, is placed in an MBE or MOVPE growth chamber and a uniform epilayer which is different from the primary substrate is grown. (Col. 6, lines 41-44). The substrate and the epilayer are removed from the growth chamber and a desired pattern of growth channels is produced, such as by using a saw or a scribe or by etching. (Col. 6, lines 44-47). After cutting, the wafer is returned to the growth chamber and annealed. (Col. 6, lines 47-49). As shown in FIG. 3B, in which the channels 22 are produced by cutting through a continuous layer of growth, the cuts may extend slightly below the surface of the wafer 20 so that the base of each channel 22 is formed by a groove 23 in the

surface of the wafer 20. (Col. 5, lines 56-61). Thus, in the first method of Tuppen, the grooves are formed in the wafer surface *after* the epilayer has been formed on the wafer. The grooves are *not* formed in the wafer surface *before* the epitaxy, as recited in claim 1.

In a second method, the primary wafer is masked, such as shown in FIG. 4, before introduction to the growth chamber. (Col. 6, lines 50-51). The masked substrate has areas 22 coated and windows 21 exposed for growth when the substrate is placed in the chamber. (Col. 6, lines 51-57). When the secondary substrate is complete, the substrate is annealed to relieve strain. (Col. 6, line 66 to col. 7, line 1). As shown in FIG. 3A, epitaxial mesas 22 are grown onto the wafer and are separated by channels 22, formed by the mask, which extend to the surface of the wafer. (Col. 5, lines 49-55). Thus, in the second method, there are no discontinuities formed in the wafer surface, let alone before epitaxy as recited in claim 1.

In the Office Action, the Examiner contended that Tuppen purportedly discloses that the silicone wafer is prepared having an array of dislocations construing a roughened like surface area on the surface of the wafer prior to the epitaxial layering on top of the wafer substrate, and that this teaching would anticipate a ring of discontinuities. Applicant respectfully disagrees.

Tuppen explains that a mismatched wafer and epilayer substrate, such as a silicone wafer and a Si/Ge alloy epilayer, have different cell sizes that may lead to problems associated with growing an epilayer on a wafer. (Col. 1, lines 24-49). As the epilayer is much thinner than the wafer, the wafer will retain its normal structure and all the strain, which causes instability, will be imposed on the epilayer. (Col. 1, lines 50-62). When the epilayer thickness is below an equilibrium critical thickness, the strain energy is insufficient to cause dislocations in the epilayer. (Col. 1, lines 62-67). However, as the thickness of the epilayer increases above a metastable critical thickness, there is enough strain energy to cause the epilayer structure to dislocate. (col. 1, line 67 to col. 2, line 7). Such dislocations are generally in the form of dislocation half loops comprising an interfacial component and two arms that thread up through the whole volume of the epitaxial layer. (Col. 2, lines 8-12).

Applicant respectfully submits that even if such dislocations could be considered discontinuities, which Applicant does not concede, these dislocations occur in the epitaxial layer, not the wafer. Additionally, such dislocations in the epitaxial layer occur after the epitaxial layer is being formed on the wafer and are *not* formed prior to epitaxy as recited in claim 1.

In view of the foregoing, claim 1 patentably distinguishes over Tuppen which does not disclose a method of forming, by epitaxy, a heteroatomic single-crystal semiconductor layer on a single-crystal semiconductor wafer in which at least one ring of discontinuities is formed in the wafer surface around a useful region, before the epitaxy. Accordingly, the rejection of claim 1 as being anticipated by Tuppen is improper and should be withdrawn.

Claims 2-6 depend from claim 1 and are patentable for at least the same reasons.

Rejections Under 35 U.S.C. §103

Claim 7 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Tuppen in view of Masato (JP 2002-359189).

Without acceding to the propriety of the combination suggested in the Office Action, claim 7 depends indirectly from claim 1 and is patentable for at least the same reasons set forth above. Accordingly, withdrawal of this rejection is respectfully requested.

CONCLUSION

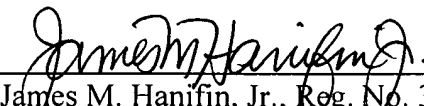
A Notice of Allowance is respectfully requested. The Examiner is requested to call the undersigned at the telephone number listed below if this communication does not place the case in condition for allowance.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicant hereby requests any necessary extension of time. If there is a fee occasioned by this response, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 23/2825.

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Respectfully submitted,

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